

NASA Global Hawk ATTREX Kick-off Meeting



**Chris Naftel
Global Hawk Project Manager
NASA Dryden Flight Research Center
25-27 August 2010**



Edwards Air Force Base and NASA Dryden Flight Research Center

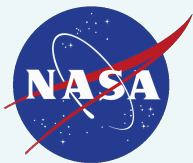


Dryden Flight
Research Center

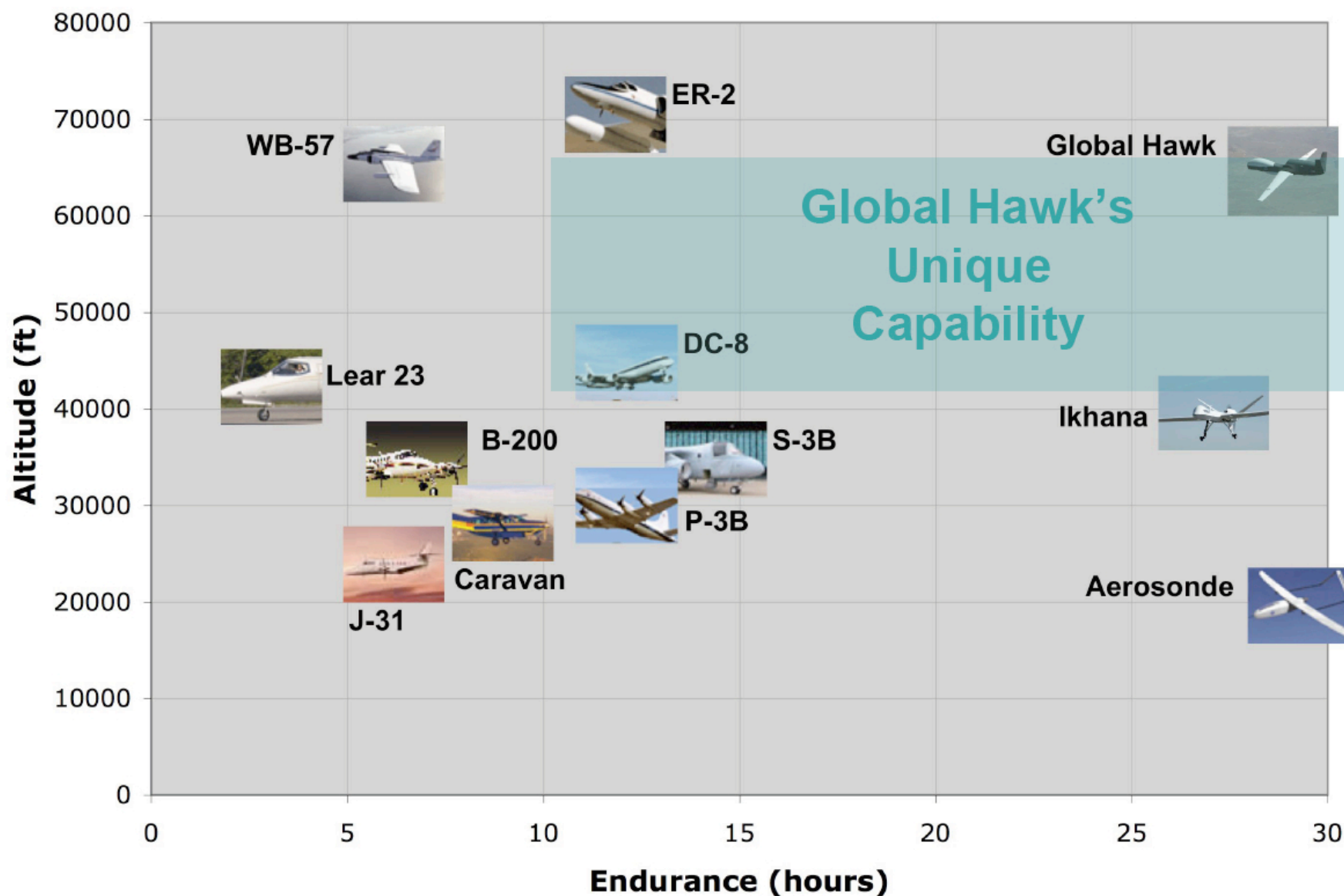
Edwards Air Force Base

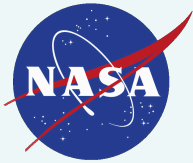


NASA Dryden Aircraft Fleet
(as of November 2008)



NASA's Airborne Science Program Aircraft Capabilities





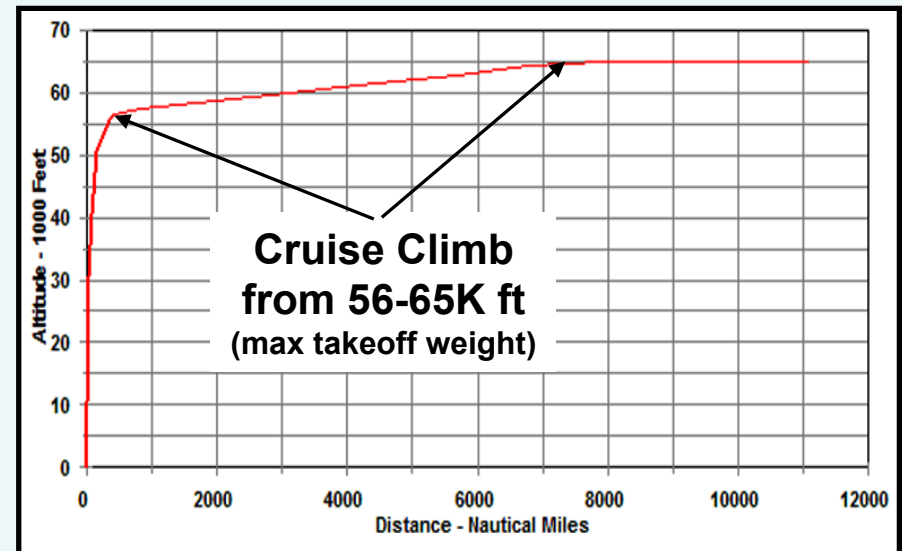
NASA Global Hawk System



- Two USAF Pre-Production Global Hawk aircraft were transferred to NASA in September 2007. (A third aircraft arrived Jan 2010)
- A combined NASA/Northrop Grumman team is maintaining, modifying, and operating the UAS through a 5-year partnership. (2008-2013)
- The first flight of the NASA Global Hawk occurred on 23 October 2009. The flight lasted 4 hours and reached 61,400 ft with no anomalies noted.



Endurance	> 30 hours
Range	>11,000 nmi
Service Ceiling	65,000 ft
Airspeed (55K+ ft)	335 KTAS
Payload	1,000-1,500 lb
Length	44 ft
Wingspan	116 ft





NASA Global Hawk Operations Overview



UAV Runway



**Mission Staging
Location**



Maintenance Hangar



**NASA Dryden
Flight
Research
Center**



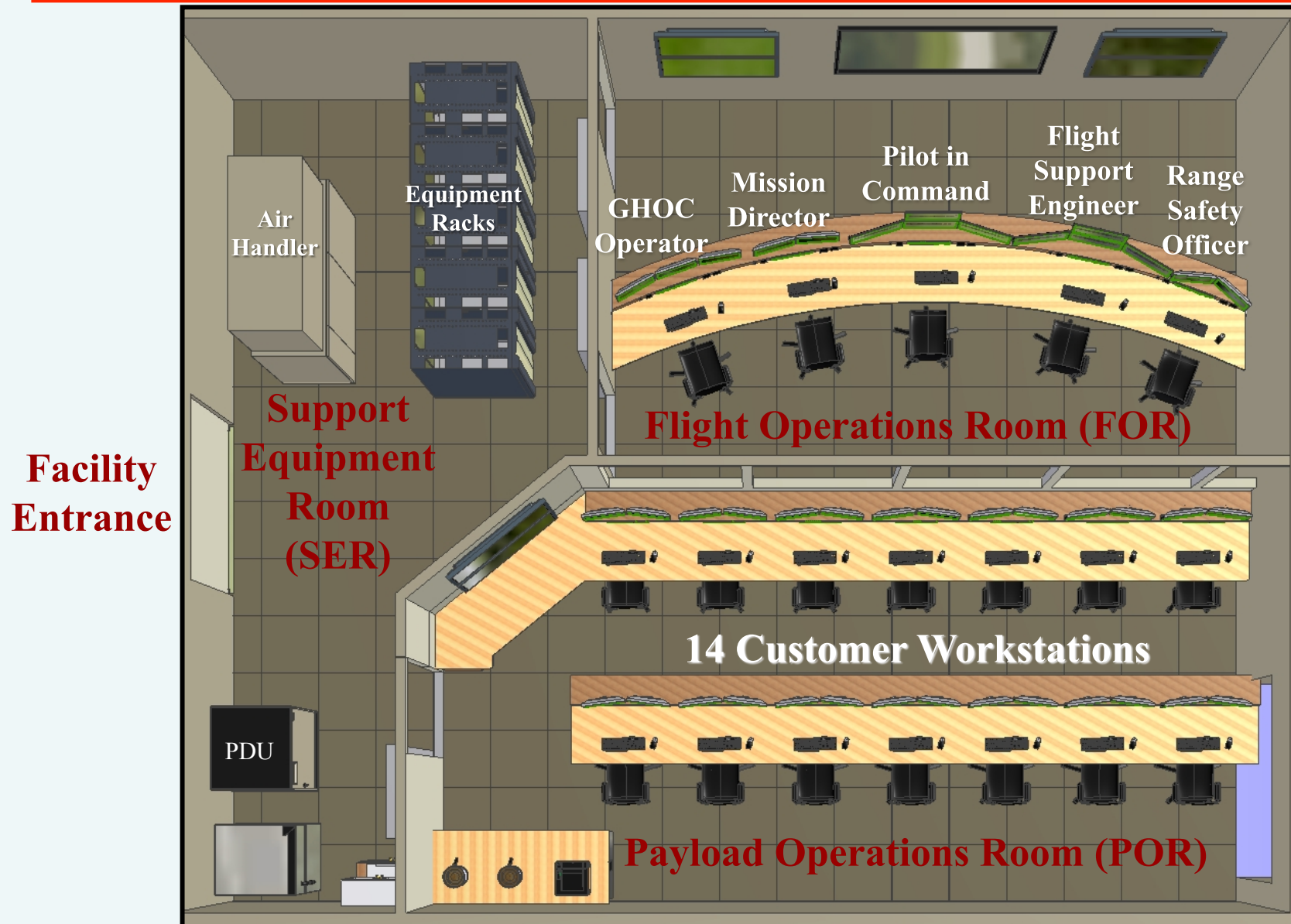
Operations Center



Edwards Air Force Base



Global Hawk Operations Center (GHOC)





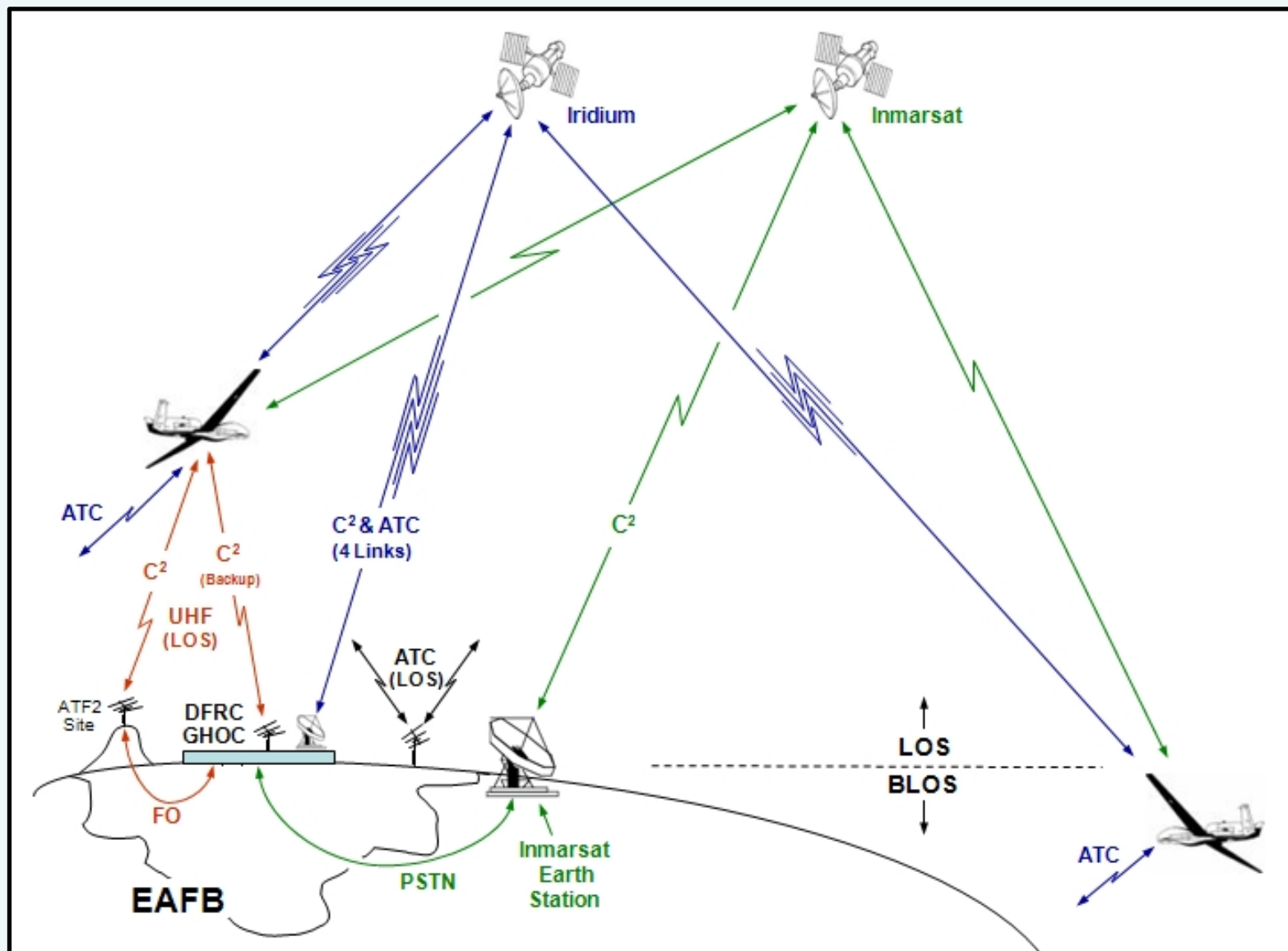
Global Hawk Operations Center (GHOC)

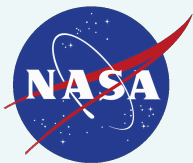


View from the Payload Operations Room

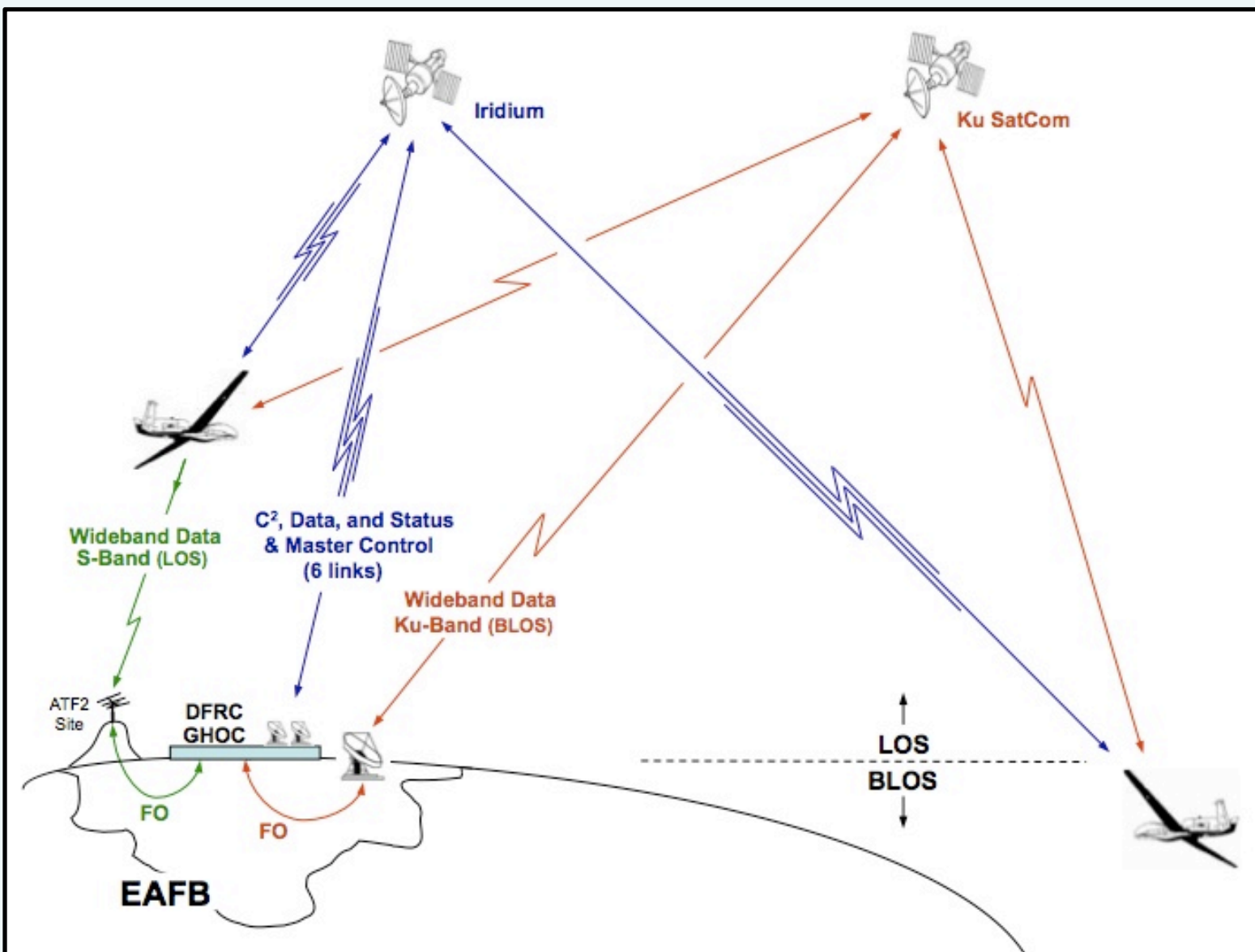


Flight Control and Air Traffic Control Communications Architecture



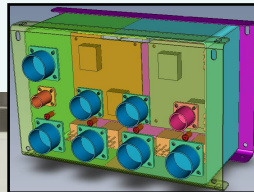


Payload Communications Architecture

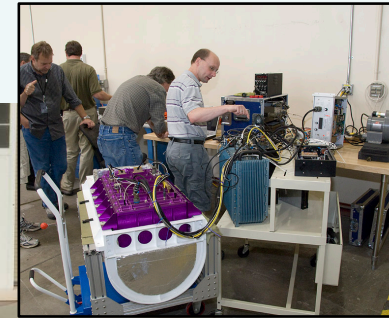




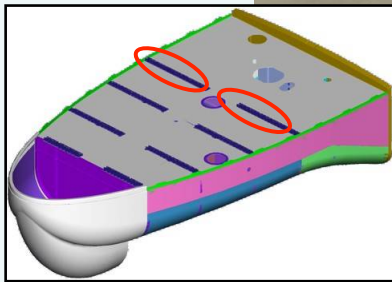
Payload Integration and Accommodations



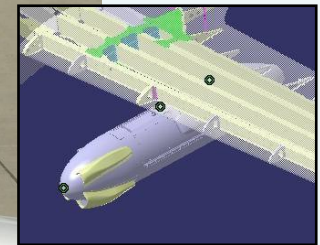
**Experiment Interface
Panel & Ethernet Switch**
(located throughout the
aircraft providing power
and communications)



**Payload Integration
Software T&E**



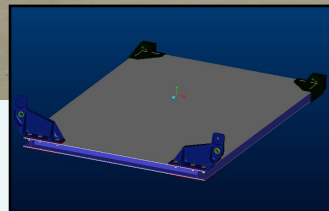
Mounting Rails



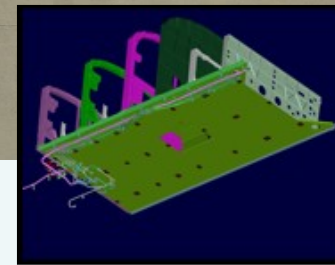
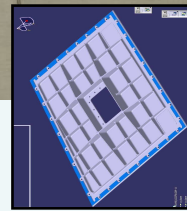
**Wing Pods
(future capability)**



**Bay Under
the Nose**

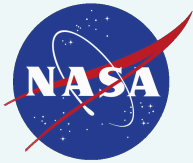


Pallets and Hatches



Mounting Hard Points

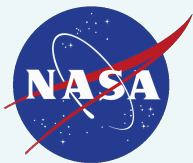




Global Hawk Project Team

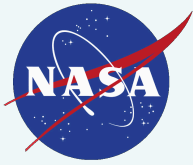


Project Management, Pilots, Aircraft Mechanics, Avionics Technicians, Operations Engineers, Software Developers, Quality Assurance, Logistics, Public Affairs, Flight Test Engineers, Crew Chiefs, Configuration Management, Systems Engineers, System Safety, Range Safety, Ground Control Station Developers, Communications Engineers



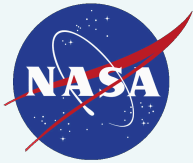
NASA Sponsorship for the Global Hawk Project





First Global Hawk Science Mission





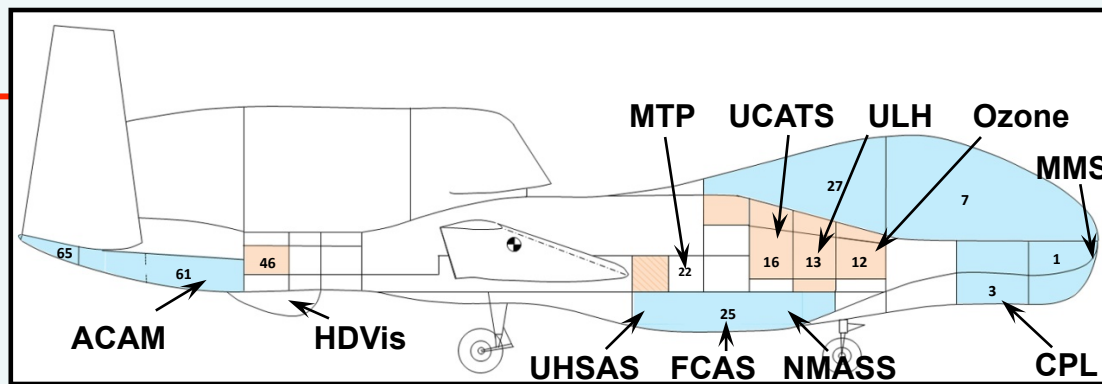
GloPac Objectives



-
- **First demonstration** of the Global Hawk unmanned aircraft system (UAS) for NASA and NOAA Earth science research and applications
 - Development of science-operation protocols & procedures
 - Long duration Pacific Ocean and Arctic flights
 - **Exploration** of trace gases, aerosols, and dynamics of remote upper troposphere and lower stratosphere regions
 - Aura satellite instrument validation
 - Sample Arctic vortex fragments, and aerosol plumes
-
- **Risk reduction** for future Global Hawk missions
 - NASA GRIP hurricanes study (Aug-Sept 2010)
 - Earth Venture (EV-1) -- ATTREX and HS3



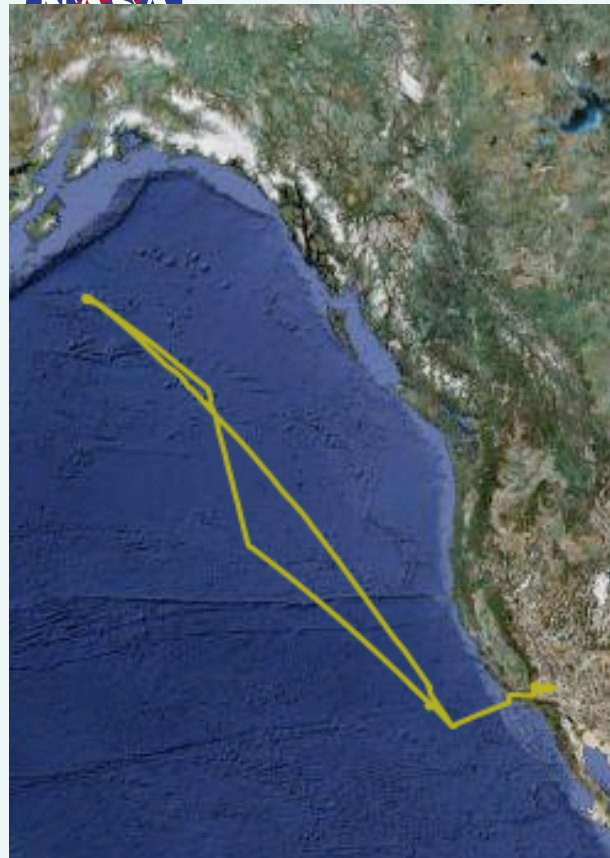
GloPac Instrument Overview



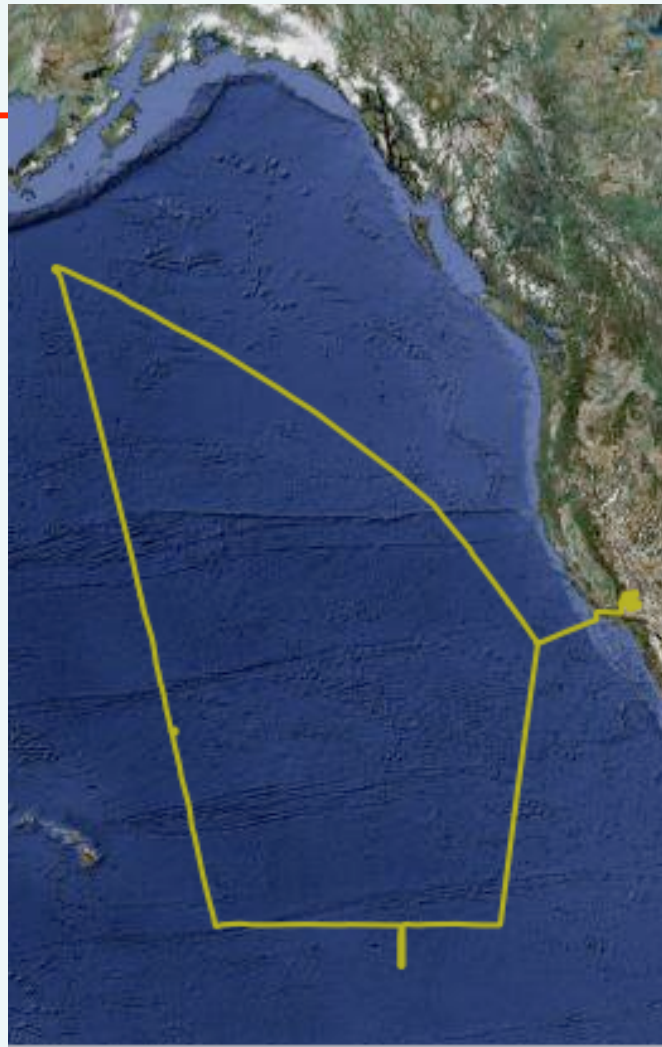
ACAM	Airborne Compact Atmospheric Mapper (GSFC)	Cross-track scanning spectrographs of NO ₂ , O ₃ , & aerosols.
CPL	Cloud Physics LIDAR (GSFC)	Backscatter LIDAR for hi-res profiling of clouds & aerosols.
FCAS	Focused Cavity Aerosol Spectrometer (U. of Denver)	Aerosol size and concentration measurements.
MMS	Meteorological Measurement System (ARC)	Science quality aircraft state variable measurements.
MTP	Microwave Temperature Profiler (JPL)	Passive microwave radiometer meas. of O ₂ thermal emissions.
HDVis	HiDef Video System (ARC)	Time-lapse nadir color digital imagery with georeferencing.
NMASS	Nuclei-mode Aerosol Size Spectrometer (U. of Denver)	Aerosol size and concentration measurements.
Ozone	UAS Ozone (NOAA)	Dual-beam UV photometer for accurate O ₃ measurements.
UCATS	UAS Chromatograph for Atmospheric Trace Species (NOAA)	Dual gas chromatographs for N ₂ O, SF ₆ , H ₂ , CO, & CH ₄ meas.
UHSAS	Ultra-High Sensitivity Aerosol Spectrometer (Droplet Measurement Technologies)	Ultra-high sensitivity aerosol spectrometer.
ULH	UAS Laser Hygrometer (JPL)	In-situ hi-accuracy atmospheric water vapor measurements.



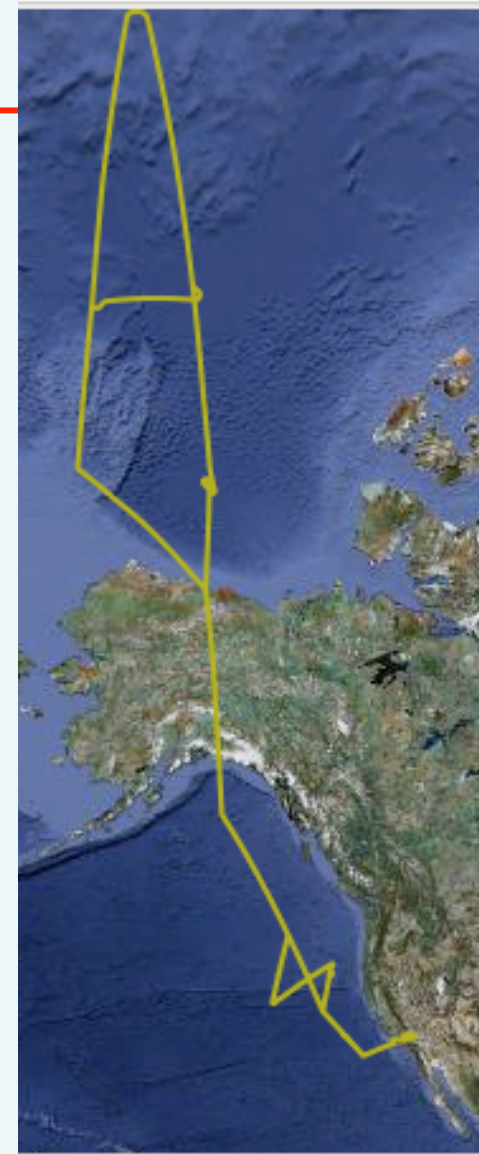
GloPac Flight Tracks



April 7th
14.1 hrs, 4600nm, 61200 ft



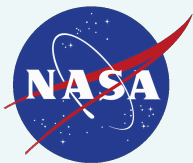
April 13th
24.3 hrs, 8000nm, 62300 ft



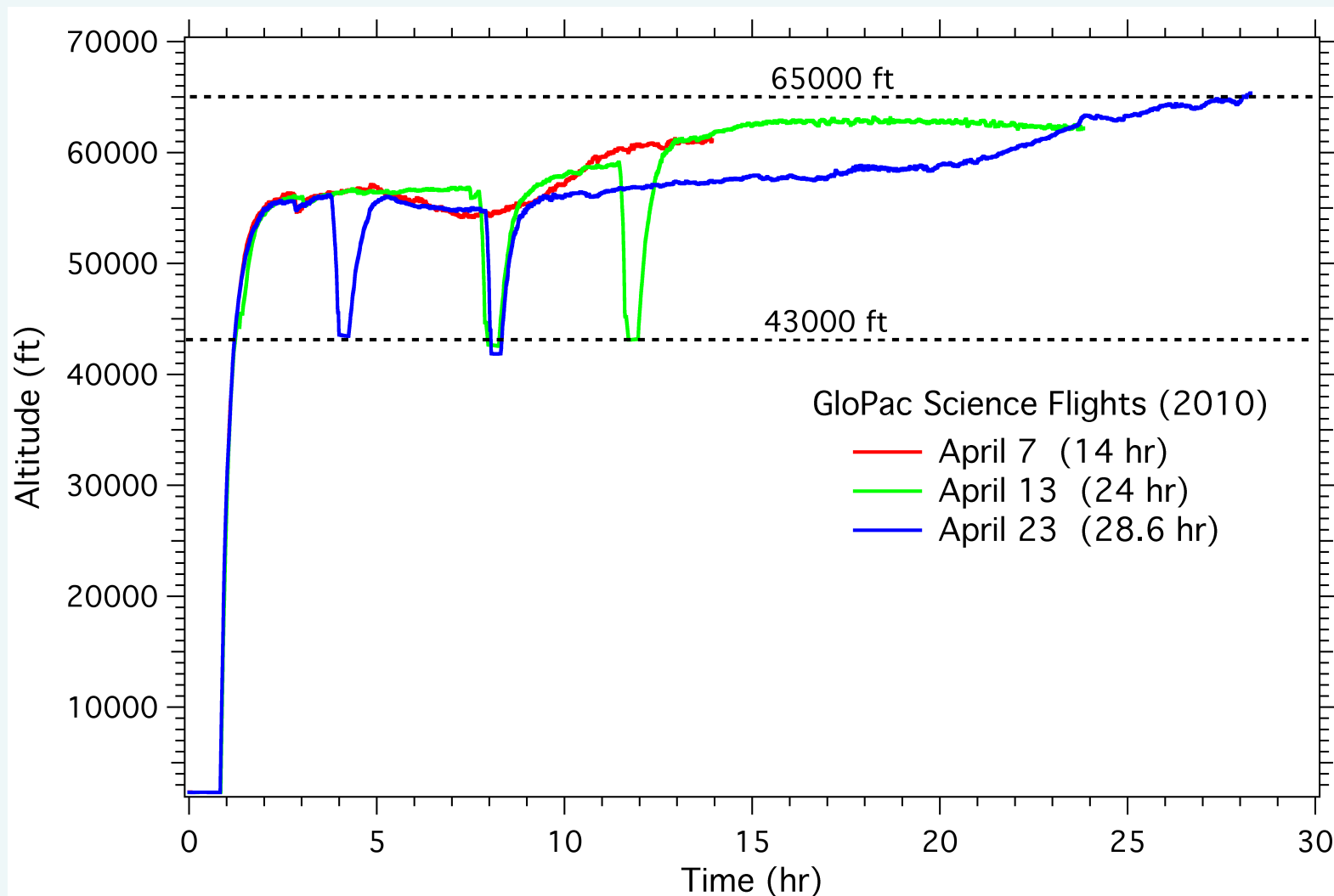
April 23rd
28.6 hrs, 9700nm, 65200 ft

(April 2: Range flight, 6.3 hrs)
(April 30: Equatorial flight attempt, 9.3 hrs)

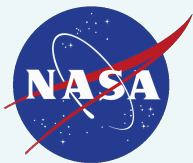
GloPac Total: 82.6 hrs



GloPac Altitude Profiles

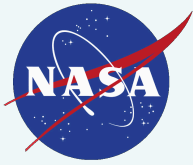


Duration, altitude ceiling, and vertical profiles maneuvers were demonstrated in GloPac.

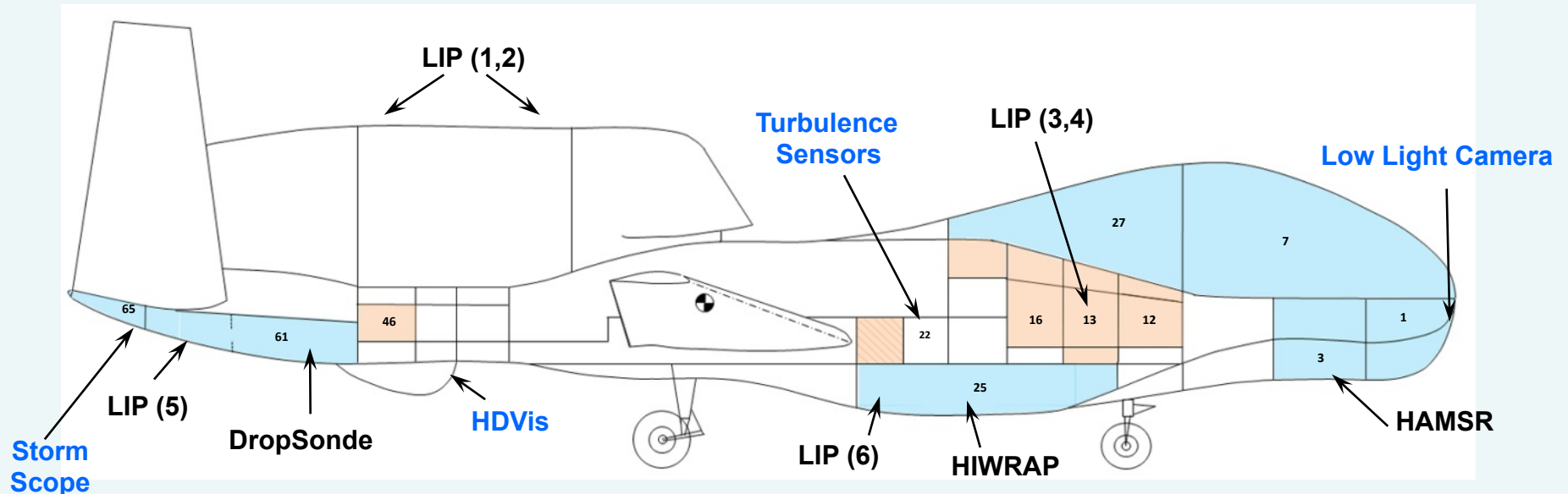


Second Global Hawk Science Mission





Genesis and Rapid Intensification Instrument and Sensor Locations



HIWRAP - High Altitude Imaging Wind and Rain Profiler

DropSonde - NOAA DropSonde System

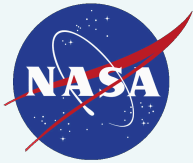
HAMSR - High Altitude MMIC Sounding Radiometer

LIP - Lightning Instrument Package

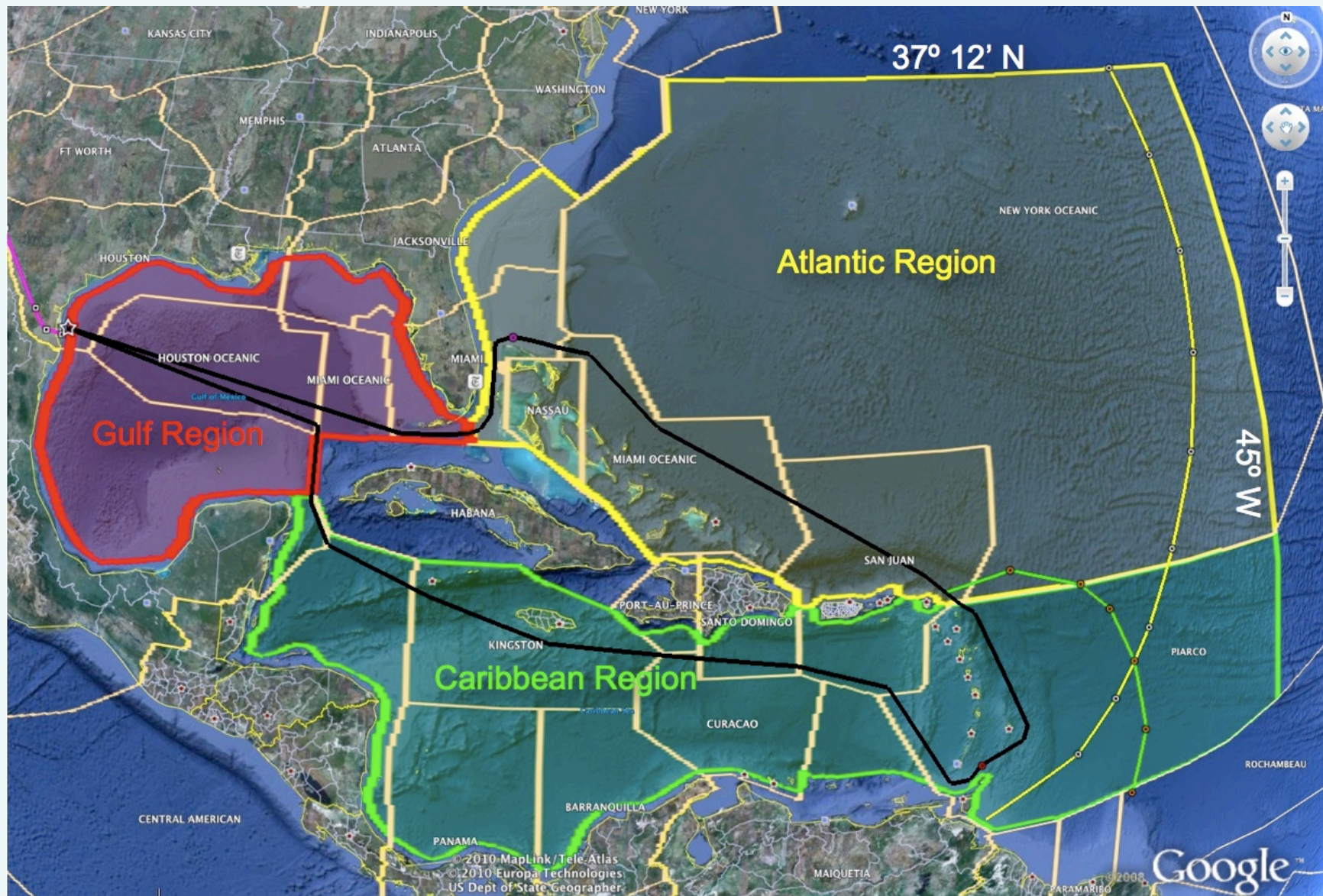
2 Cameras - HDVis and Low Light for Pilot Situational Awareness

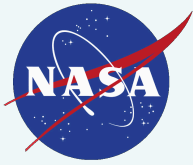
Storm Scope - Lightning Detection Display in the GHOC

Accelerometers - Real-time Turbulence Time-history Display in the GHOC



GRIP Primary Areas of Interest

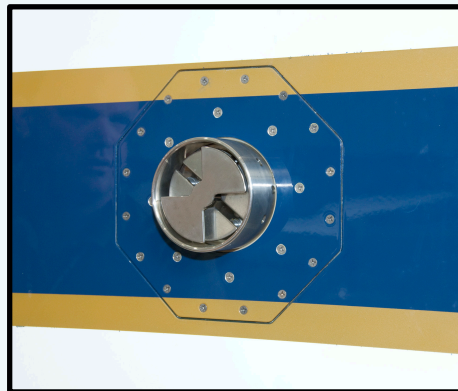


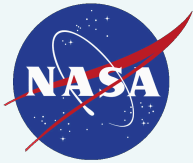


GRIP Status



- All 4 instruments are installed on the aircraft.
- Range flight, for initial instrument check-out, conducted on Aug 15.
- Dropsonde test flight conducted on Aug 24 – the first drop was successful.
- First hurricane mission later this week.





Future Mission Capability

Portable Ground Station Available Aug 2012

